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USSR STANDARD FOR AVIATION OILS (GOST 1013-41)

(Petroleum Industry B 23)

I. DEFINITION AND DESIGNATION

1. Aviation oils are lubricating oils prepared from products of direct distillation of petroleum. Aviation oils are used for lubricating aircraft engines.

II. CLASSIFICATION

2. This standard establishes three grades of aviation oils: (a) MK summer aviation oil, of acid-diatomaceous earth refining; (b) MS summer aviation oil, of selective refining; (c) MZS winter aviation oil, of selective refining.

III. TECHNICAL SPECIFICATIONS

3. In producing aviation oils, depending on their grade, the following raw materials are used:

a. For MK aviation oil: select Surakhany oil and Emba oils (Makat Jurassic, Makat Permotriassic, Baychunas, Sagiz, and Dossor).

b. For MS aviation oil: MK aviation oil and any mixture of select Surakhany and Karachukhur oils.

c. For MZS aviation oil: any mixture of Dossor and Sagiz oils, with allowable 20% admixture of Makat Jurassic oil.

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ARMY	X	AIR	X	FBI								

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4. Appearance of aviation oil poured into a test tube: thick oily fluid ranging in color from yellow to red, fluorescent in reflected light.

5. Physicochemical properties of aviation oils must meet the following requirements:

		MK Aviation Oil	MS Aviation Oil	MZS Aviation Oil
1.	Specific gravity d_4^{20}, not over	0.905	0.895	0.890
2.	Viscosity at 100° C			
	a. Kinematic, in cst, not less than	22.4	20.2	14.3
	b. The corresponding conventional, degrees Engler not less than	3.15	2.9	2.25
3.	Ratio of kinematic viscosity, cst, at 50° C to kinematic viscosity, cst, at 100° C, not over	8.75	7.85	6.55
4.	Flash point (Pensky-Martens), °C not below	230	225	200
5.	Flash point discrepancy (Brenken and Pensky-Martens), °C, not over	20	20	20
6.	Acid number, mgKOH per g of oil, not over	0.1	0.07	0.25
7.	Coking capacity (Conradson), %, not over	0.7	0.3	0.35
8.	Ash content, %, not over	0.004	0.003	0.003
9.	Color (Duboscq), mm, not less than	20	30	16
10.	Congelation point, °C, not above	-14	-11	-30
11.	Mechanical impurities		None	
12.	Water content		None	
13.	Content of water-soluble acids and alkalies		None	
14.	Content of selective solvents		None	

NOTE: 1. Provisions for MK aviation oil from Emba oils:

a. Kinematic viscosity at 100° C, not less than 20.2 cst.

b. Ratio of kinematic viscosity at 50° C to kinematic viscosity at 100° C, not over 8.55.

c. Acid number, not over 0.35 mgKOH/g.

d. Coking capacity (Conradson), not over 0.8%.

e. Color (Duboscq), not less than 8 mm;

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ii. Provisions for MS aviation oil from Emba oils:

a. Acid number, not over 0.15 mgKOH/g.

b. Coking capacity (Conradson), not over 0.4%.

c. Color (Duboscq), not less than 12 mm.

iii. For all grades of aviation oils an admixture of "paraflow" not over 0.1% is allowed.

iv. Provisions for MS aviation oil from select Surakhany and from Karachukhur oil:

a. Congelation point, not above -18° C.

b. Content of selective solvents, not over 0.002%.

IV. RULES OF INSPECTION

6. For inspection, a shipment of packed aviation oil is subdivided by cars. The technical inspector takes samples from 20%, or not less than two samples each from the barrels or containers.

If oil is shipped in tank cars, samples are taken from each car.

7. The samples are mixed; from the average sample obtained, 1.5 liters of oil are taken and poured into two clean 1-liter bottles. The contents of one bottle are submitted to the laboratory for testing; the second bottle is closed with a clean cork waxed with paraffin, sealed, and kept for 3 months for possible umpire analysis (in case of shipments to the Far East, for 6 months).

8. The samples are taken as prescribed by OST 314 (replaced by GOST 2517-44).

V. TEST METHODS

9. Determination of specific gravity is carried out as prescribed by OST VKS 7872, M.I. 3a, 3b, 3v, 3g-35, the determination according to M.I 3v being carried out by the dilution method mentioned in M.I. 3b.

10. Determination of viscosity is carried out as prescribed by GOST 33-40 (replaced by GOST 33-46).

NOTE: For factory control and for inspection tests, determination of viscosity of all aviation oils at 100° C as well as that of the MZS aviation oil at 50° C is allowed to be carried out as prescribed by OST VKS 7872, M.I. 5b-35 and 5g-35.

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11. Determination of flash point (Pensky-Martens) is carried out as prescribed by OST VKS 7872, M.I. 12v-35.

12. Determination of flash point (Brenken) is carried out as prescribed by OST VKS 7872, M.I. 12d-35.

13. Determination of acid number is carried out as prescribed by OST NKTP 7872/2292, M.I. 25g-36, a microburette being employed for titration.

14. Determination of coking capacity (Conradson) is carried out as prescribed by OST VKS 7872-39, M.I. 24m.

15. Determination of ash content is carried out as prescribed by OST NKTP 7872/2292, M.I. 26b-36.

16. Determination of coloration (Duboscq) is carried out as prescribed by OST VKS 7872, M.I. 16b-35 after dissolving 15 volumes of colorless ligroin and comparing the solution with a ST W*PW glass.

17. Determination of congelation point. Congelation point of aviation oil is defined as the temperature at which the tested oil thickens enough to maintain a stationary level for 5 min when the test tube containing the product is tilted 45°.

a. Application

This method is used in factory control and in inspection and umpire tests.

b. Apparatus

A test tube with inner diameter of 16±1 mm and height of 160±10 mm.

A roundbottomed sleeve tube with inner diameter of 40±1 mm and height of 130±10 mm.

A cylindrical container for the freezing mixture (wood, porcelain, glass, or iron with heat insulation) with height not less than 160 mm and diameter not less than 120 mm.

A thermometer for checking congelation points of petroleum products (GOST 400-41) with inspection certificate by a state inspector of the Committee on Measures and Measuring Instruments under the Council of People's Commisars USSR.

A thermometer of any kind properl graduated for checking temperature of the freezing mixture.

A rack with a holder for the sleeve tube.

A water bath.

c. Reagents

Sulfuric acid, specific gravity 1.84, or oleum.

Table salt and fine-crushed ice or snow -- for temperatures from 0-20° C.

Denatured alcohol and solid carbon dioxide (dry ice) -- for temperatures from 0-50° C. In the absence of carbon dioxide, other freezing mixtures may be used.

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d. Preparing a Freezing Mixture With Solid Carbon Dioxide

The container for preparing the freezing mixture is filled with alcohol to two thirds of its height, and, while stirring, small portions of carbon dioxide are added. As the temperature drops, portions of carbon dioxide are gradually increased; care must be taken that as new portions are added no alcohol is splashed up and ejected. After intensive effervescence has ceased, the container is cautiously filled with alcohol up to the desired level.

e. Preparation of Test

The product under test is poured into a dry clean test tube to 30 mm level; care must be taken that it does not spread on the walls of the tube.

A thermometer for checking congelation points is tightly inserted into the tube by means of a cork so as to keep it fixed along the axis of the tube, its bulb being 6-10 mm above the bottom of the tube.

The tube with the product and the thermometer is dipped into the water bath preheated to $50 \pm 1^{\circ}$ C; once the product is heated up to this temperature, it is kept in the bath for 10 min.

f. Making of Test

The sleeve tube is filled with 0.5-1.0 mm of sulfuric acid (specific gravity 1.84) or oleum. The tube with the product and the thermometer is taken out of the water bath, wiped dry on the outside, and fixed in the sleeve tube by means of a cork so as to keep its walls roughly equidistant from the walls of the sleeve tube. The device thus assembled is fixed vertically in the holder of the rack and left at room temperature until the product cools off to $25 \pm 5^{\circ}$ C, whereupon it is transferred to the container with the freezing mixture kept at a temperature 5° C below the expected congelation point.

When the thermometer indicates that the product has reached the proper temperature, the test tube is held vertically at that temperature for 5 min. The apparatus is then tilted 45°, and is kept thus in the freezing mixture for 5 min.

After this the device is carefully taken out of the freezing mixture, the sleeve tube quickly wiped off, and the meniscus of the tested product checked for shifting.

If the meniscus has shifted at the set temperature, the test tube is taken out of the sleeve tube, reheated to $50 \pm 1^{\circ}$ C, and kept at that temperature for 10 min, whereupon a new test is carried out at a temperature 4° C below the previous one, and so on, until at some temperature the menicus ceases shifting.

NOTE: If the testing temperature was below -20° C, prior to a new test, the device should be protected from harmful thermic effects. For this purpose, the test tube with the product and the thermometer is left at room temperature until the product in the tube warms up to -20° C, and only after this is the tube put into the water bath.

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If the meniscus has not shifted at the set temperature, the test tube is taken out of the sleeve tube, reheated to 50± 1° C, and kept at that temperature for 10 min. Then a new test is carried out at a temperature 4° C above the previous one, and so on, until at some temperature the meniscus starts shifting.

After having determined the congelation boundary (transition from mobility to immobility, and vice versa), the test is repeated lowering or raising the testing temperature by 1° C until the temperature is determined at which the meniscus of the product does not shift. In a test repeated at this temperature plus 1° C, the meniscus should shift. This temperature is then considered the one sought for in the congelation point test.

In establishing the congelation point of a product, two parallel tests are carried out whose results must not show a discrepancy over 2° C.

g. Establishment of Test Data

The congelation point of aviation oils is determined by the arithmetical mean of temperature readings obtained in two parallel tests.

18. Determination of mechanical impurities is carried out as prescribed by OST 7872-39, M. I. 19v.

19. Determination of water content is carried out (1) at the bases of the Main Administration for Petroleum Sales and at the consumer's, as prescribed by OST VKS 7872, M.I. 19a-35; and (2) at the manufacturer's, by the qualitative "crepitation" method under heating in an oil bath.

a. Apparatus

A glass test tube 10-15 mm in diameter, 120-150 mm high; a chemical thermometer graduated in single degrees up to 200° C; a gas or any other kind of burner; an oil bath consisting of a cylindrical container about 100 mm in diameter and about 90 mm high provided with a metal lid. The lid is connected with a metal disk attached to it by means of a metal brace and fixed 10 mm above the bottom of the bath; the lid and the disk have apertures for placing, respectively, the thermometer and the test tubes.

b. Preparation of Test

The bath is filled up to the 80 mm level with mineral oil having a flash point not below 240° C, fixed on a rack, and heated up to 175±5° C.

A glass test tube, carefully washed then dried with warm air, is filled at room temperature with the oil under test to the 80-90 mm level. The tube is stoppered by a cork pierced with a dry thermometer whose bulb must be equidistant from the walls of the tube and placed 20-30 mm above the bottom of the tube.

c. Making of Test

The tube with oil under test is placed vertically into the preheated bath, the tube and the oil being observed for several minutes until the oil in the tube reaches a temperature of 150° C. In case the oil under test contains water, the oil becomes foamy and spits; the tube quivers; and the oil on the tube walls above the oil level becomes cloudy.

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d. Establishment of Test Data

Presence of water is considered certain if a distinct crackling sound is heard not less than twice.

The test must be repeated if either of the following is observed during the first test: (1) a solitary distinct crackle with foaming; (2) slight crackle with foaming; (3) foaming only.

If a solitary distinct crackle with foaming takes place in the test when repeated, presence of water is considered certain. If in the second test, after heating the test tube to 130° C, only slight crackle with foaming, or foaming alone, is observed, the oil under test is considered containing no water.

20. Determination of content of water-soluble acids and alkalies is carried out as prescribed by OST NKTP 7872/2292, M.I. 25ye-37.

21. Determination of nitrobenzene (selective solvent) content is carried out as prescribed by OST 7872-39, M.I. 231.

VI. PACKING AND MARKING

22. Aviation oils are delivered in tanks, wooden barrels grade 1 and 2 (as prescribed by GOST 174-41), in tin-plate or galvanized cans, or in other packing acceptable to USG KA.

23. Tanks, barrels, and cans must be absolutely clean and prepared to be filled with oils.

24. Packed oil must be immediately closed: tanks and cans are closed with lids with oiled pasteboard padding; wooden barrels, with wooden plugs covered with oiled cotton fabric.

25. Plugs of wooden barrels are bound with iron plates.

26. Each barrel must carry a stenciled label, and each can must be provided with a tag, showing name of the manufacturing plant, grade of the oil, tare and gross weight, GOST 1013-41, lot number, and filling date.

VII. STORING AND HANDLING

27. Each grade of aviation oil is stored in its special separate reservoir or in the barrels and cans in which it is handled.

28. In tanks, aviation oil is delivered only to storehouses and points which have separate piping for decantation, or sufficient packing material suitable for oil storage.

29. Prior to pumping aviation oil into reservoirs, the reservoir must be carefully examined and cleaned of remnants of other products, of contamination, and of water.

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30. When aviation oils are poured into tanks, barrels, cans, or other containers, the latter must be absolutely clean and contain no remnants of other products.

Handling of oil in unwashed and undried containers is prohibited.

31. Before decanting aviation oil from tanks into reservoirs, delivered oil must be checked in accordance with this standard.

Oil is decanted via absolutely clean pipes into cleaned, dried, closed, and absolutely serviceable reservoirs, which exclude any possibility of the oil becoming contaminated with moisture.

If it is necessary to warm up oil for decantation, this must be carried out by passing steam through a blind coil pipe. Warming up by direct blowing of steam into oil is prohibited.

32. Barrels and containers with oil must be stored in a place protected from the direct rays of the sun and from precipitation.

Proposed by the People's Commissariat of Petroleum Industry USSR.

Approved by the Council of People's Commissars USSR, 5 September 1941.

Effective 1 October 1941.

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